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On 30 November 2004  
(DATE OF DEPOSIT)

Thomas C. Stover 22,531  
NAME OF APPLICANT, ASSIGNEE, OR REG. REP.

 30 November 2004  
SIGNATURE DATE

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Divisional application of  
Phillip G. Wapner et al  
Application Serial No. 10/024,836  
Filed: 19 Dec 2001

Group Art Unit: 1733  
Examiner: J. Rossi

For: MICROTUBES WITH AXIALLY VARIABLE GEOMETRIES AND METHOD  
OF MANUFACTURING SAME

Honorable Commissioner for Patents  
Washington D. C. 20231

Sir:

### DECLARATION UNDER 37 C.F.R. 1.132

We, Philip G. Wapner and Wesley P. Hoffman, both of Palmdale, California, declare and say that:

1. We each are co-inventors of the above-identified application, having an effective filing date of 17 March 1999.
2. We also are co-inventors of USP 6,059,001, that issued on 9 May 2000, in our names and that of Gregory J. Price of San Diego, California.

3. USP 6,059,001 has been cited by the USPTO in a rejection dated 30 April 2001, against claims 35-38 and 40-42, in the above-identified patent application. The '001 patent has a filing date of 7 June 1995 and issued on 9 May 2000. The present application is a Divisional Application of what is now USP 6, 458,231 B1 (issued on 1 October 2002), which was filed on 17 March 1999, well before the above issue date of the '001 patent so that the one year prior publication bar does not apply.

4. The '001 patent discloses but does not claim, subject matter in the present application which is now claimed. That is, the '001 patent, which while disclosing subject matter relative to the present application, only directs its claims to a winding apparatus for producing mandrels for microtube devices.

5. We can unequivocally state that only we two conceived or invented the relevant (unclaimed) subject matter disclosed in the above '001 patent that is now included in the specification and claims of the present patent application. But such subject matter is relied upon by the USPTO in the above rejection, which, subject matter, however, is attributed to two different inventive entities. But, as stated above, the relevant subject matter in the '001 patent and the present application are under common inventorship.,


6. Copies of the title page of the above '001 & 231 patents are attached hereto as Exhibits A&B and a copy of the filing receipt for the present patent application is attached hereto as Exhibit C.

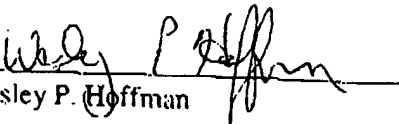
7. We further declare that statements made herein are made of our own knowledge and are true and that all statements made on information are believed to be true and furthermore that

these statements are made with the knowledge that willful false statements of the like so made, are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the above application or any patent issuing thereon.

26 November 2004  
Date

26 November 2004  
Date

  
Phillip G. Wapner

  
Wesley P. Hoffman

# United States Patent [19]

Wapner et al.

[11] Patent Number: 6,059,001

[45] Date of Patent: \*May 9, 2000

## [54] APPARATUS FOR MANUFACTURING MICROTUBES WITH AXIALLY VARIABLE GEOMETRIES

[75] Inventors: Phillip G. Wapner; Wesley P. Hoffman, both of Palmdale; Gregory J. Price, San Diego, all of Calif.

[73] Assignee: The United States of America as represented by the Secretary of the Air Force, Washington, D.C.

[\*] Notice: This patent is subject to a terminal disclaimer.

[21] Appl. No.: 08/472,574

[22] Filed: Jun. 7, 1995

### Related U.S. Application Data

[63] Continuation-in-part of application No. 08,229,962, Apr. 15, 1994.

[51] Int. Cl.<sup>7</sup> ..... B65H 81/00

[52] U.S. Cl. .... 156/425; 156/155; 156/247; 156/428; 156/429; 156/430

[58] Field of Search ..... 156/425, 428, 156/429, 430, 173, 175, 169, 172, 148, 247, 155

### [56] References Cited

#### U.S. PATENT DOCUMENTS

4,051,284 9/1977 Ohkubo et al. .... 156/247 X  
5,187,399 2/1993 Carr et al. .  
5,189,323 2/1993 Carr et al. .  
5,252,881 10/1993 Muller et al. .

5,262,695 11/1993 Kuwano et al. .  
5,366,587 11/1994 Ueda et al. .  
5,378,583 1/1995 Guckel et al. .  
5,426,942 6/1995 Suzuki .  
5,789,045 8/1998 Wapner et al. .... 428/34,4  
5,888,436 3/1999 Keith ..... 264/103

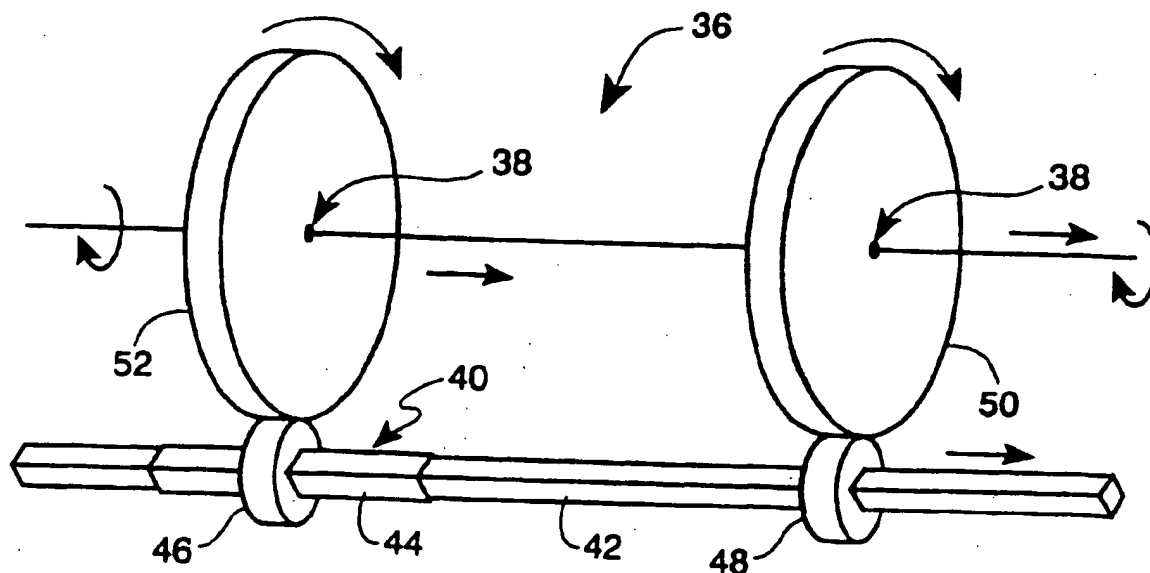
Primary Examiner—Jeff H. Aftergut

Attorney, Agent, or Firm—Stanton E. Collier

### [57] ABSTRACT

The present invention is a technique for manufacturing microtube devices which have circumferential geometries repeated either uniformly or nonuniformly along the tube or device axis with sub-micron precision. The preferred manufacturing process involves forming a complex mandrel and giving it a metallic and/or nonmetallic coating or coatings by any of a variety of techniques. The mandrel can then be removed by appropriate chemical or physical means, leaving a microtube structure having an axial profile consisting of repeat units duplicating those on the mandrel. One technique for forming the complex mandrel consists of drawing a single core fiber (or bundle of core fibers) through a confining orifice. The fiber is held with minimal constraint (typically by friction), so that no breakage takes place as it is drawn through the orifice. However, enough constraint exists so that torque applied tangentially by another overwrapping fiber (or fibers) as it is being wound around the core fiber does not cause the core fiber to slip in the direction of applied torque. Moreover, the overwrapping fiber must be wound sufficiently close to the constraining orifice that twisting of the core fiber in the direction of torque is minimized to such an extent that unwinding, or "backlash" does not occur when constraining forces are removed at the end of winding.

9 Claims, 4 Drawing Sheets





US006458231B1

(12) **United States Patent**  
**Wapner et al.**

(10) **Patent No.:** **US 6,458,231 B1**  
(45) **Date of Patent:** **Oct. 1, 2002**

(54) **METHOD OF MAKING MICROTUBES WITH AXIALLY VARIABLE GEOMETRIES**

(75) Inventors: **Phillip G. Wapner; Wesley P. Hoffman**, both of Palmdale, CA (US)

(73) Assignee: **The United States of America as represented by the Secretary of the Air Force**, Washington, DC (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/274,820**

(22) Filed: **Mar. 17, 1999**

(51) Int. Cl.<sup>7</sup> ..... **B65H 81/00**

(52) U.S. Cl. .... **156/173; 156/175; 156/169; 428/36.3**

(58) Field of Search ..... **156/148, 155, 156/166, 169, 173, 175; 604/526, 527; 264/281; 428/36.3**

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

2,614,058 A	*	10/1952	Francis	154/83
3,879,516 A	*	4/1975	Wolvek	264/135
5,700,253 A	*	12/1997	Parker	604/282
5,704,926 A	*	1/1998	Sutton	604/282

5,879,499 A	*	3/1999	Corvi	156/175
5,947,940 A	*	9/1999	Beisel	604/282
6,030,371 A	*	2/2000	Pursley	604/282
6,059,001 A	*	5/2000	Wapner et al.	156/425

\* cited by examiner

*Primary Examiner*—Jeff H. Aftergut

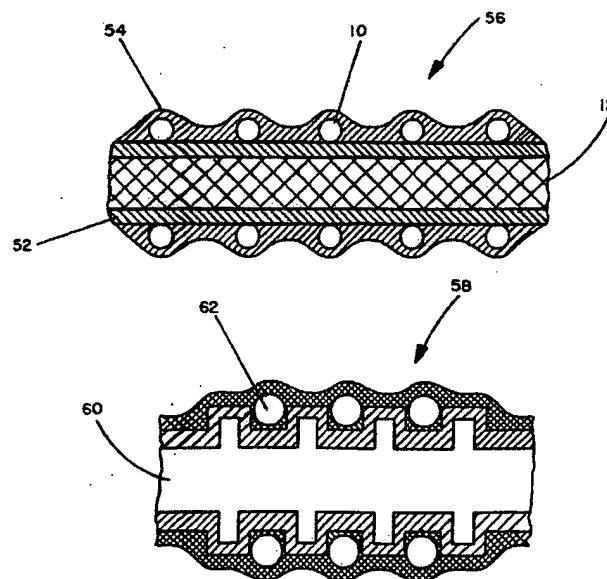
*Assistant Examiner*—Jessica Rossi

(74) *Attorney, Agent, or Firm*—Thomas C. Stover; Stanton E. Collier

(57) **ABSTRACT**

In the present invention, a technique is described for manufacturing microtube devices which have peripheral geometries that are not uniform along the tube or device axis. These geometries may exist in only one location on the periphery of the microtube device or geometries may be repeated either uniformly or non-uniformly with micron or sub-micron precision along the tube or device axis. The preferred manufacturing process involves forming a complex mandrel, ie., (one, for example, that can not be formed by extrusion or pultrusion under constant processing conditions) and giving it at least one metallic and/or non-metallic coating by any of a variety of techniques. The complex mandrel can then be removed by appropriate chemical or physical means that do not adversely affect the coating(s) desired for the wall. The result is a microtube structure having an axial profile duplicating that on the mandrel from which it was formed.

**18 Claims, 22 Drawing Sheets**



**Exhibit B**



## UNITED STATES PATENT AND TRADEMARK OFFICE

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WASHINGTON, D.C. 20231  
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APPLICATION NUMBER	FILING DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO.	DRAWINGS	TOT CLAIMS	IND CLAIMS
10/024,836	12/19/2001	1762	740	AFB00612	17	19	3

CONFIRMATION NO. 5454

## FILING RECEIPT



\*OC000000007439884\*

Stanton E. Collier  
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40 Wright St.  
Hanscom AFB, MA 01731-2903

Date Mailed: 02/07/2002

Receipt is acknowledged of this nonprovisional Patent Application. It will be considered in its order and you will be notified as to the results of the examination. Be sure to provide the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION when inquiring about this application. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please write to the Office of Initial Patent Examination's Customer Service Center. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections (if appropriate).

## Applicant(s)

Phillip G. Wapner, Palmdale, CA;  
Wesley P. Hoffman, Palmdale, CA;

## Domestic Priority data as claimed by applicant

THIS APPLICATION IS A DIV OF 08/472,574 06/07/1995 PAT 6,059,001

## Foreign Applications

If Required, Foreign Filing License Granted 02/07/2002

Projected Publication Date: Request for Non-Publication Acknowledged

Non-Publication Request: Yes

Early Publication Request: No

## Title

Microtubes with axially variable geometries and method of manufacturing same

## Preliminary Class

427

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